Airport Communications Systems (ACS) Design Manual

DCA - Ronald Reagan
Washington National

IAD - Washington
Dulles International

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Chapter I

Introduction

This document provides a summary, references or excerpts of codes, outlining design and construction specifications for telecommunications at Ronald Reagan National and Washington Dulles International Airports. Each section defines minimum design guidelines for the installation and/rearrangement of telecommunication facilities. Telecommunication facilities include all cable infrastructure, pathways, equipment and related entities. The implementation of the aforementioned guidelines will provide consistent deployment of telecommunications services throughout the airport campuses.

The Metropolitan Washington Airports Authority Design Manual is intended for use by capable engineers and telecommunication contractors in the design and/or installation of telecommunication equipment; by inspection authorities exercising legal jurisdiction over telecommunication installations; by property insurance inspectors; by qualified industrial, commercial, and residential telecommunications contractors; and by instructors of telecommunication apprentices or students.

Chapter II

Codes, Regulations and Standards

I. Introduction

Telecommunications installations are regulated by building codes and standards. These are normally adopted and enforced by a local jurisdictional agency. Codes and standards encompass most, if not all, aspects of the telecommunications industry. Installation methods and electrical products must conform to local code requirements.

II. Abbreviations (Acronyms, Abbreviations, etc.)

(See Attachment)

III. References

NFPA 70-1999, National Electric Code
OSHA 29 CFR part 1910.146, General Industries, Confined space Permit
BICSI Telecommunications Distribution Methods Manual, 9th Edition

Reference Organizations:
American National Standards Institute (ANSI)
Electronic Industries Alliance (EIA)
Federal Communications Commission (FCC)
Institute of Electrical and Electronics Engineers Inc (IEEE)
International Organization for Standardization (ISO)
National Electrical Manufacturers Association (NEMA)
National Fire Protection Association (NFPA)
Occupational Safety and Health Administration (OSHA)
Telecommunications Industry Association (TIA)
Underwriters Laboratories (UL)
Telcordia Technologies (formerly Bellcore)

IV. Codes

Codes pertain to electrical codes, building codes, fire codes, and all other safety codes. In general, the purpose of codes is for the practical safeguarding of persons and property from hazards and to ensure the quality of construction.

V. Regulations

The design of an effective telecommunications system requires the designer to be familiar with international, national, and local regulations. International, national, and local authorities publish rules that govern:

Local carriers
Inter-exchange common carriers
The telecommunications industry
Post, telephone and telegraph (PTT)

U.S. Federal Regulations

At the federal level in the United States, the Federal Communications Commission's (FCC's) Part 68 Rule provides regulations for connecting premises cabling and customer-provided equipment to the regulated networks.

U.S. State Regulations

At the state level in the United States, many public utility/service commissions issue their own rules in addition to monitoring tariffs. State rules are generally in accordance with FCC regulations.

The state commissions' rules and service provider (SP) tariffs are available to the public. Certain sections of these rules and tariffs deal with installing telecommunications wire and cable facilities on private and public property.

VI. Standards

The purpose is to ensure a minimum level of performance. Codes often reference numerous safety standards to ensure the minimum safety requirements of a given material or component.

Chapter III

Inside Plant – Copper

I. Vertical Distribution Systems

The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) fully supports and recommends implementation and compliance with BICSI TDMM recommendations detailed in Chapter 5, Backbone Distribution Systems, Pages 1-144. Comprising Backbone Building Pathways, Backbone Building Cabling, Campus Pathways, and Campus Cabling.

VII. Horizontal Distribution Systems

The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) fully supports and recommends implementation and compliance with the BICSI TDMM recommendations detailed in Chapter 4, Horizontal Distribution Systems, Pages 1-124, compromising of Horizontal Pathway Systems and Horizontal Cabling Systems.

VIII. Conduit

In addition to the specifications aforementioned in Section II; Horizontal Cabling;

1. All communication cabling will be installed in an approved pathway (conduit and/or cable tray).
2. Stand-alone, exposed cabling is not permissible.
3. The Metropolitan Washington Airports Authority requires that each tenant have an approved telecommunications demarcation point. The Metropolitan Washington Airports Authority will provide all necessary pathways and cabling to that tenant demarcation point.
4. Airport tenants are responsible for all design and placement of telecommunication facilities within their space in accordance with this manual.
5. Minimum conduit sizing will be (1”) one inch.
6. Non-metallic wire ways shall not be used.

IX. Grounding

All grounding shall comply with article 250 of the current National Electrical Code (NEC), ANSI NFPA –780, ANSI/TIA/EIA-607, ANSI/IEEE-1100, and BICSI recommendations in Chapter 17 of the TDMM; Pages 1-44. These references outline specifications frequently needed for electrical protection and/or construction prints.

X. Cable Tray

Cable trays shall be permitted for all communications cable types except CMX and CMUC, communications raceways described in 800.51 of the NEC code shall be allowed to be installed in cable trays. Cable tray installation shall comply with Article 318 of the current National Electric Code and BICSI recommendations in Section 4 of the TDMM: Page 75-86.

The aforementioned Articles cover cable tray systems including ladder, ventilated trough, ventilated channel, solid bottom, and other structures. Cable trays are best defined as a unit or assembly of units or sections and associated fittings forming a rigid structural system used to securely fasten or support cables and raceways.

XI. Labeling

All communication cables will be identified at each end with a permanent tag or label with the same alphanumeric identifiers.
The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) requires all cabling to conform to the following design:

Premise and station cabling include all copper, fiber and coaxial cable within a building from a Building Entrance Terminal (BET) through communications rooms up to a point proximate of a tenant demarcation point, if a tenant is involved, or to the operating jack, if not tenant is involved.

Horizontal and vertical fiber and copper cable wiring connecting telecommunication rooms are identified by the building number, by the originating and terminating telecommunication room, and by the type and number of fibers or copper wires.

Cables are numbered sequentially using the following 12-character format:

aa 2-character identifier for type of cable
- fs for SM fiber
- fm for MM fiber
- sm for combined SM and MM fiber
- cp for copper premises
- cx for coax

xx 2-digit number of the originating IDF room or closet, normally the IDF closet to the MDF and/or BET

xx 2-digit number of the terminating IDF room or closet temporary room identifiers may be used during building construction. final as-built drawings must show room numbers assigned by the Authority in order for the drawings to be accepted.

xxxx 4-digit number indicating the number of fibers or copper wires

xx 2-digit sequential cable number, such as 01, 02, etc.

The following 12-character labeling format applies to station cable and wiring:

aa 2-character station identifier for type of cable
- cs for copper station
- fs for fiber station

cf for copper and fiber service
xs for coax station
xc for coax and copper service
sf for coax and fiber service

xxxxx 5-digit numerical room number temporary room identifiers may be used during building construction. Final as-built drawings must show room numbers assigned by the Authority in order for the drawings to be accepted

x 1-digit number identifying the purpose of the cable
2- for voice (telephone)

aa 1-character or 2-character alpha or alphanumeric identification of a wall jack, beginning with "A" or "AA" and sequentially clockwise around the room from the main room entrance.

xx 2-digit number of the station termination

XII. LAN Drop/Data cabling shall conform to the following format:

As rooms within Airport buildings do not always have an identifying number, the labeling of data connections has been inconsistent. This standard will provide a benchmark for numbering jacks when a room number is available and when there are no room numbers. The same numbering scheme will be employed at both ends of the data cable. Data jacks within each room will be identified in a clockwise rotation, i.e., left to right, with this reference being made while looking into the room from the doorway. The numbering scheme will be placed on the terminating jack above its respective RJ45 position utilizing a P-Touch labeling machine. Font size will be at 8 point, so that the 8 characters can be printed on the top and bottom of the label. The label will also be placed above its respective patch panel RJ45 position. The identifying label will be formatted as follows:

Row 1: floor # (1-9), Room number or common identifier (5 alphanumeric characters)
Row 2: Jack # (01-99), Patch panel identifier (A-Z), Patch panel port (01-96)

A typical example of a data jack identifier would be:
1BG259 or 2FRHSE
01 A 05 01 A 05

When rooms do not have an official Airport room number assigned, a common abbreviation that best depicts the location will be utilized.

XIII. Installation Hardware

Horizonal Hardware Systems, at a minimum, consist of telecommunications outlets, recognized cable type, cross-connect wire and patch panels, jumpers and patch cords used to configure horizontal cable connections in the telecommunications room, cable racks, wire management and ladder rack.

Vertical Hardware Systems, at a minimum, consist of twisted pair copper, coax, and connecting hardware, i.e. connecting blocks, patch panels, interconnections and cross-connect blocks.

All hardware shall meet TIA/EIA Industry Standards and meet ISO 9001 Requirements.

Backboards: 0.75 inch (19mm), interior grade, fire retardant treated plywood, painted.

Relay Racks: 84" Height x 19" Width, black color.

Vertical Wire Management: AFCO double-sided, part number, AS-CTRG-84-W-GRY

Horizontal Wire Management: CPI 19", Upper Tray Gray, Part number: 12183119.

Data Patch Panels: Siemon, Cat 6 – 568A configuration, RJ45.

Data Patch Cords: Cat 6, Blue, 568A configuration, RJ45 Termination, 4 pair each end.

Jumper Wire: 24/26 gauge, Single pair / Two pair

Jacks: Flush mount unless denoted.

Siemon CT2-FP-04, 1 port Flush Mount Unloaded Single Gang Accepts 1 Coupler, Gray.

Siemon CT4-FP-04 2 port Flush Mount Unloaded Double Gang for 2 CT Couplers, Gray.

Siemon CT4-FP-04, 4 Port Flush Mount Unloaded Double Gang for 4 CT Couplers, Gray.

Siemon CT-F-C6-C6-04, 2 Port Modular Jack, 110 8W8P UTP T568A/B Category 6 XP7, Flat Coupler Gray.

Siemon CT-F-C6-04 1 Port Modular Jack, 110 8W8P UTP T568A/B Category 6 XP&, Flat Coupler Gray.

Blocks: 110 AT&T terminations, 300 pair with C-4 or C-5 clips per application.

Station Cable: Category 6, 4 pair, Comscope – Yellow (Voice) and Blue (Data) – solid copper conductors.

XIV. Termination Methods

All cable shall be terminated in accordance with the manufacturer specifications, ANSI, TIA/EIA 568A standards and BICSI, TDMM recommendations as outlined in Sections 4 and 5.

No intermediary splicing of station cables will be permitted.

All switchroom and telecommunications closet terminations shall be made on AT&T 110 blocks. (Voice)

Cross-connect fields must maintain, at a minimum, a 2-inch service loop on both ends of the connection. Cross-connect fields will follow the following guidelines at all times:

Color Code For Cross-connect Fields:

White / Blue	Single Line Sets
White / Orange	Digital Sets
Yellow / Blue	Dry Pairs
Red / White	Alarm Circuits
Black / White	Pay Telephones
White / Blue & White / Orange	56 K Circuits
Red / Blue & Red / Orange	T-1

XV. Testing

In a multi-pair cable, the test should indicate:

1. Continuity to the remote end.
2. Shorts between any two or more conductors.
3. Transposed pairs.
4. Reversed pairs.
5. Split pairs.
6. Shield continuity (only for shielded cables).
7. Ground conductors.

When testing category 6 station cables, manufacturer guidelines and ANSI/TIA/EIA 568A standards shall be employed.

Category 6 cable: This category consists of cables and connectors specified up to 250 MHz. The performance of Category 6 cabling links corresponds to application Class E links to be specified in ISO/IEC 11801 and CENELEC EN 50173.

XVI. Documentation

All documentation shall be submitted in both hard and soft copy. As-built drawings must be submitted to the Metropolitan Washington Airports Authority in AutoCAD format. Copper test results shall be submitted in EXCEL format.

XVII. Inside Plant – Fiber

XVIII. Vertical Distribution Systems

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4. Airport tenants are responsible for all design and placement of telecommunication facilities within their space in accordance with this manual.
5. Minimum conduit sizing will be (1") one inch.
6. Non-metallic wire ways shall not be used.

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Premise and station cabling include all copper, fiber and coaxial cable within a building from a Building Entrance Terminal (BET) through communications rooms up to a point proximate of a tenant demarcation point, if a tenant is involved, or to the operating jack, if not tenant is involved.

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xx 2-digit number of the terminating IDF room or closet temporary room identifiers may be used during building construction final as-built drawings must show room numbers assigned by the Authority in order for the drawings to be accepted.

xxxx 4-digit number indicating the number of fibers or copper wires.

xx 2-digit sequential cable number, such as 01, 02, etc.

The following 12 character labeling procedures apply to station cable and wiring:

aa 2-character station identifier for type of cable
- cs for copper station
- fs for fiber station
- cf for copper and fiber service
- xs for coax station
- xc for coax and copper service
- sf for coax and fiber service

xxxxx 5-digit numerical room number temporary room identifiers may be used during building construction final as-built drawings must show room numbers assigned by the Authority in order for the drawings to be accepted.

x 1-digit number identifying the purpose of the cable 2- for voice (telephone)

aa 1-character or 2-character alpha or alphanumeric identification of a wall jack, beginning with “A” or “AA” and sequentially clockwise around the room from the main room entrance.

xx 2-digit number of the station termination

XXIV. Installation Hardware

All hardware shall meet TIA/EIA Industry Standards and meet ISO 9001 Requirements.

Main Distribution Panel: Minimum size per installation :
72-Port LIU FDC-CMH-072-L

Connectors:
Multi-Mode 6-Position Unit FDC-CPIP-25-M/M
Single Mode 6-Position Unit FDC-XPIP-19-S/M

Splice Trays for FDC-CMH LIU Units:
One per 12-fibers, 6 maximum per unit M-67-041

Wall Connection Center (WIC):
12-Fiber Cabinet WIC-12
24-Fiber Cabinet WIC-24

Connector Panels for WIC Units:
Multi-Mode 6-Position WIC-CPI-25-MM
Single Mode 6-Position WIC-CP-19-SM

Splice Trays for WIC Units:
One per 12-fibers M-67-060

Fan-out Kits (6-Strand and 12-Strand) To be used only on loose-tube buffer fiber per manufacturer specifications

XXV. Termination Methods

All cable shall be terminated in accordance with the manufacturer specifications, ANSI, TIA/EIA 568A standards and BICSI, TDMM recommendations as outlined in Section 5, Pages 131-132.
All fiber optic terminations shall be accomplished through field connectorization. Field connectorization occurs when an optical fiber connector is installed onto the individual fibers in the field.
Pigtail splicing is not allowed under any circumstances on the ACS fiber plant.

XXVI. Testing

Testing is crucial in assuring the overall integrity and performance of the fiber cable. All fibers will be tested with an OTDR. Applicable wavelengths shall be tested on each fiber. Refer to BICSI TDMM Manual 9th edition, Chapter 10, Field Testing, Pages 10-20 through 10-39 for acceptable test methods.

XXVII. Splicing:

When a continuous length of fiber cable cannot be installed, only a single-fiber fusion splice will be allowed.

XXVIII. Documentation:

All documentation shall be submitted in both hard and soft copy. As-built drawings must be submitted to the Metropolitan Washington Airports Authority in AutoCAD format.
Copper test results shall be submitted in EXCEL format.

Chapter IV

Outside Plant-Copper

I. Manholes, Handholes and Conduit:

The term Outside Plant (OSP) once referred almost exclusively to cable facilities placed and maintained by the original telephone companies operating on a capitalized (i.e., regulated) basis. After deregulation, the customer or a local service provider (SP) became responsible for the installation and maintenance of these cable facilities, either directly or through contractors.

For detailed recommendations on design and installation of OSP telecommunications facilities refer to BICSI TDMM, 9th edition, Chapter 5, Section 3 and 4, Campus Pathways and Cabling; and also, Chapter 9, Building Entrance Facilities and Terminations.

All outside cable plant must be installed in conduit.

II. Grounding, Protection, and Terminations:

The electrical protection of telecommunications facilities is covered in the National Electrical Code (NEC), American National Standards Association (ANSI), and the Institute of Electrical and Electronics Engineers, INC (IEEE).

Also refer to BICSI TDMM, 9th Edition, Chapter 17, Grounding, Bonding and Electrical Protection.

Gas protection devices to be installed on all cable that requires grounding; larger than 25 pair, shall be CIRCA 1880E Series gas protector, with 4B1EW gas protector modules installed on each cable pair.

III. Splicing:

All splice cases shall be manufactured by the vendor “Preformed” and filled with re-enterable encapsulant. Splice modules shall be type 710.

IV. Permits:

Applicable permits must be obtained from the appropriate Metropolitan Washington Airports Authority Maintenance and Engineering organization.

V. Testing:

Testing is crucial in assuring the overall integrity and satisfactory performance of cabling systems. Proper testing maximizes the longevity of the system, minimizes downtime and maintenance, and facilitates system upgrades or reconfigurations. At a minimum, cable pairs shall be tested to indicate continuity to the remote end, shorts between any two or more conductors, transposed, reversed, or split pairs, and shield connectivity. Refer to BICSI TDMM Chapter 10, Field Testing for Procedures and Standards.

VI. Labeling:

All outside plant cables must be labeled with permanent tags at both ends, and at all access points along the sheath (Manholes, handholes, pullboxes, etc.). The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) requires all outside copper plant cabling to conform to the following design:

1. Copper backbone cables are labeled ACS-xxx-xxxx where the “xxx” indicates the number of pairs, in ACS - xxx cables originate from a telephone switch MDF and are numbered sequentially.
   Example: ACS-101, where the “1" indicates the number of the originating MDF or node and the “01" is the number of the cable originating from the MDF or node.

2. BETs are identified by the building number. If a building has multiple BETs, each BET must be labeled sequentially using characters A to Z beginning with the first BET in the cable routing.
   Example: BET-1 indicates a single BET for building "1". BET-1A indicates a building having multiple BETs, where "1" is the building number and “A” indicates a particular BET.

VII. Documentation:

All documentation shall be submitted in both hard and soft copy. As-built and manhole butterfly drawings must be submitted to the Metropolitan Washington Airports Authority in AutoCAD format. Copper test results shall be submitted in EXCEL format.

VIII. Cable Types:

All underground cable shall be gel filled, 24-gauge solid, annealed, copper conductors, twisted pair design and shall have an aluminum shield (.008 thickness) and a black polyethylene jacket. Only the standard American telephone color code shall be used.

Outside Plant-Fiber

IX. Manholes, Handholes, Conduit and Innerduct:

In order to ensure physical cable protection, all fiber cables are to be installed utilizing innerduct. Innerduct is a non-metallic pathway placed within a larger pathway.

X. Terminations:

All fiber shall be terminated using ST type ceramic or metal connectors. Connectors shall meet TIA/EIA-4750000B (Generic Specifications for Fiber Optic Connectors) and TIA/EIA-604-2 (Fiber Optic Connector Intermateability Standards) Specifications. Pigtail splicing is not allowed under any circumstances on the ACS fiber plant.

XI. Splicing:

When a continuous length of cable cannot be installed, only a single-fiber fusion splice will be allowed.

XII. Permits:

Applicable permits must be obtained from the appropriate Metropolitan Washington Airports Authority Maintenance and Engineering organization.

XIII. Testing:

Testing is crucial in assuring the overall integrity and performance of fiber cable. All fibers will be tested with an OTDR. Applicable wavelengths shall be tested on each fiber. Refer to the BICSI TDMM Manual 9th edition, Chapter 10, Field testing Pages 10-20 through 10-39.

XIV. Labeling:

All outside plant cables must be labeled with permanent tags at both ends and at all access points along the sheath (Manholes, handholes, pullboxes, etc.). The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) requires all outside fiber plant cabling to conform to the following design:

N 1 character to identify the cable as a network fiber type
aa 2-digit number indication the number of SM fibers
bbb 3-digit number indicating the number of MM fibers
xx 2-digit number identifying the originating building, normally the principle source of the signal carried on the cable, such as a telephone switch
vv 2-digit number identifying the terminating building
zz 2-digit sequential cable number, such as 01, 02, etc.

XV. Documentation:

All documentation shall be submitted in both hard and soft copy. As-built and manhole butterfly drawings must be submitted to the Metropolitan Washington Airports Authority in AutoCAD format.

XVI. Cable Types:

Optical fiber cable for outdoor use should be a loose-buffer-tube-type cable that contains a water-blocking compound for water resistance, as well as, for allowing some expansion and contraction with temperature changes. Cables manufactured with fiberglass rods or aramid yarn (all-dielectric cable) will be used. Cables with steel strength members or steel armoring will not be used. Minimum RML bandwidth of 220 MHz.km at 850 nm with laser performance @ 1300 nm specified to achieve 300 meters for Gigabit Ethernet (IEEE 802.3z) standard-compliant links.

Chapter V

Equipment and Telecommunication Rooms

This chapter highlights requirements for equipment rooms and telecommunications rooms. The design of either telecommunication or equipment rooms must adhere to all recommendations outlined in Chapters 7 and 8 of the BICSI TDMM, rev. 9 and all applicable NEC, ANSI and ISO Standards.

Telecommunications rooms differ from equipment rooms and entrance facilities in that they are generally considered to be floor-serving (as opposed to building or campus serving) spaces that provide a connection point between backbone and horizontal distribution pathways. Equipment rooms are special-purpose rooms that provide space and maintain a suitable operating environment for large communication and/or computer equipment. Equipment rooms may be connected to backbone pathways that run both within and between buildings.

I. Telecommunication rooms

Provide an environmentally and secure area for installing:

1. Cables
2. Cross-connect fields
3. Rack and Wall-mounted Hardware
4. Telecommunications equipment

II. Equipment Rooms:

1. Contain terminations, interconnections, cross-connections for telecommunication distribution cables
2. Include work space for telecommunication personnel
3. Are built and designed per stringent requirements because of the nature, cost, size and complexity of the equipment involved.

III. Sizing

The design of telecommunication rooms depends on the following factors:

1. Size of the building
2. Floor space served
3. Occupant needs
4. Telecommunications service used (i.e. special applications)
5. Future requirements

The design of equipment rooms depends on the following factors:

1. Space required for equipment
2. Size and variety of equipment

3. Size of the area to be served
4. Provision for future expansion
5. Access for delivery and installation of large equipment and cables
6. Proximity to electrical service and mechanical equipment
7. Sources of electromagnetic equipment
8. Relationship to service entrances for telecommunications and electrical power
9. Access and proximity to telecommunications cable pathways (including installations in which the equipment room serves multiple backbones)

Space allocation for both equipment rooms and telecommunication rooms must comply with recommendations provided in sections 7 and 8 of the BICSI TDMM, rev. 9. These sections describe and define specific space allocation, layout, lighting, electrical power, environmental control requirements, floor, ceiling and wall requirements, power conditioning, cable installation and pathways. Industry standards, Regulatory and Safety standards applicable to equipment and telecommunication rooms are also outlined.

IV. Power

Telecommunication rooms must be equipped to provide adequate electrical power. Requirements are as follows:

1. Branch circuits for equipment power must be protected and wired for 20A capacity.
2. A minimum of two dedicated non-switched 3-wire 120-volt AC duplex electrical outlets on separate branch circuits is required for equipment power.
3. Light switch locations should be coordinated for easy access upon entry.
4. All outlets must be on non-switched circuits.
5. Convenience outlets must be identified and marked.
6. Additional outlets or power strips may be required depending on the amount and type of equipment to be installed.
7. Emergency power must have automatic switchover capability.
8. At a minimum, one outlet must be on normal power and one must be on emergency power.
9. Distribution panels serving telecommunications equipment must be separate from those serving lighting fixtures

Equipment rooms must be equipped to provide adequate electrical power based upon:

1. Equipment manufacturer's guidelines
2. Local electrical code requirements
3. Codes outlined in the latest edition of the National Electric Code (NEC).
4. Commercial power quick-disconnect panels must be installed in locations that do not have uninterruptible power to the equipment room.

V. Security and Access

All telecommunication and equipment rooms, not located in Tenant space, shall be equipped with card reader access. The Metropolitan Washington Airports Authority Telecommunications Division (MA-620) shall control granted access.

VI. Environmentals

Telecommunications equipment is sensitive to environmental conditions and typically has strict manufacturer requirements for its operating environment.

Therefore, equipment rooms must have at a minimum:

1. Dedicated HVAC equipment or access to the main HVAC delivery system
2. Humidity control
3. Dust control

Telecommunications rooms must have HVAC that will:

1. Maintain continuous and dedicated environmental control (24 hours per day, 365 days per year)
2. Maintain positive pressure with a minimum of one air change per hour
3. Dissipate the heat generated by active devices
4. Satisfy applicable building codes
5. Satisfy all equipment manufacturer requirements
6. Maintain a temperature in the following ranges:

No active equipment: 10 degrees C to 35 degrees C (50 degrees F to 95 degrees F). It is preferable that the temperature is maintained to within +/- 5 degrees C (+/- 9 degrees F) of the adjoining office space and that humidity be kept below 85% relative humidity (non-condensing).

Houses active equipment: 18 degrees C to 24 degrees C (64 degrees F to 75 degrees F). The humidity range should be 30% to 55% relative humidity (non-condensing).

All HVAC systems shall have sufficient drainage to prevent condensation or water drainage to telecommunications equipment, wiring or the equipment room itself.

VII. Floors

The design of all telecommunications and equipment rooms must comply with the minimum ANSI/TIA/EIA/569-A floor loading requirements of 2.4 kPa. Actual floor loading will be dependent on the equipment to be installed and the floor loading rating. In order to keep dust and static electricity at a minimum, all telecommunications rooms shall be tiled and all equipment rooms will be covered in anti-static tile. Carpet and non-sealed concrete shall not be allowed in either telecommunications or equipment rooms.

VIII. General Room Finish

All walls must extend from the finished floor to the structural ceiling, be covered with two coats of fire retardant white paint or other light colored finish and be fire-rated as required by the applicable codes and regulations. In telecommunications rooms, where equipment racks are not provided, at least one wall must be lined with AC-grade or better plywood, 2.4 m (8 foot) high

with a minimum thickness of 19mm (0.75 inch), fire rated and painted to match the other walls of the room.

IX. Fire Suppression/Protection

A fire alarm shall be installed in all equipment rooms according to national and local codes. A portable fire extinguisher with appropriate ratings will be installed as close to each entrance as possible. Each room must have multiple exit routes per NFPA 101, Life Safety Code. If electronic equipment is to be placed in the room, waterless fire suppression must be installed. Where no electronic equipment is to be installed within the space, liquid fire protection may be deployed. Wire cages or other protection must be installed to prevent sprinkler heads from accidental activation.

All fire suppression shall meet NFPA and local fire codes.

Chapter VI

Paging

Overhead paging systems provide users with the capability to access their paging system from their telephone set. Paging systems can be designed for single, multi or all zone coverage. If required, the paging system can have access from a remote location. The voice paging equipment is connected to speakers or paging horns and distributed throughout a building where announcements are to be made to local personnel.

I. Telephone Access:

Paging access is provided by dialing an access code or pressing a key on the telephone to make voice announcements. A second way to access paging is to utilize a stand alone microphone when telephone access is unavailable.

II. Hardware:

Currently the Airport uses Bogen equipment for large applications (Over 2 speakers) and Valcom equipment for small installations (Under 2 speakers).

The Metropolitan Washington Airports Authority requires shielded speaker wire and ¾ inch conduit for all speaker/horn locations.

The applications, distance, number of speakers, wattage of speakers and paging amplifiers will determine the gauge of the shielded speaker wire to be installed.

All ceiling speakers will require ceiling bridges, a metal enclosure (High Hat) over the speaker and conduit / flex fasten to the speaker enclosure.

III. Design Specifications

Except for the Valcom paging system, all paging systems installed with telephone access, will be 70-volt systems. The impedance to the speakers will be 8 ohms. Impedance matching transformers from 1/8 watt to 5 watt will be used.

The wattage for the paging horns will be determined by the applications and coverage that is required.

The power requirements of the paging amplifiers will be determined by the application:

1. Add the sum of all speaker tap wattages of each speaker.
2. Add the sum of all speaker wire power loss.
3. Add to the sum, for possible future growth on the paging system, another 25% power so the amplifier will be operating at 75% of the rated power for the amplifier.

All paging systems will be required to have battery back-up on the system to keep it active for a minimum of 4 hours.

The following questions must be answered:
General:

1. Are any floor plans available for use in the design?
2. Are there any drawings of the existing system?
3. Are there any existing warranty or maintenance contracts in place?
4. Are there any plans to expand in the future?
5. Are there any future plans to add features to the system? (Telephone access, Radio, Crashnet?)

Specific:

1. Is there a need for zone paging? How many zones?
2. Is there a need for exterior paging?
3. Are there any locations that will need a separate volume control? (Conference room, Training room)
4. What types of inputs to the system will be required? (Telephone, Microphone, Alert tones, Crashnet, Radio, Door bell)

Chapter VII

Safety

State and Federal Law, as well as Metropolitan Washington Airports Authority policy and procedures, make the safety and health of all employees and contract personnel the first consideration on any project. To do this, everyone must constantly be aware of conditions in all work areas that can produce or lead to injuries. This section is written to emphasize the importance of safety, provide guidelines for specific telecommunications safety and confined space entry. The Metropolitan Washington Airports Authority Risk Management Division (MA-27), in tandem with Local, State and Federal regulatory entities, establishes all safety policies and nothing in this section shall override such regulation.

I. Reference Organizations

National Fire Protection Association
Occupational Safety and Health Administration (OSHA)
Verizon
Underwriters Laboratories Inc (UL)

II. References

OSHA 29 CFR part 1910
OSHA 29 CFR part 1910.146 Permit Required for Confined Space
Underwriters Laboratories, Inc (UL) – Standard for Safety- Communication Circuit Accessories
National Electric Code
Verizon Health and Safety Manual

III. Definitions

Asphyxia: Lack of oxygen and interference with the oxygenation of the blood.

Attendant: Individual stationed outside one or more permit spaces that monitors the authorized entrants and performs the attendant's duties assigned in the employer's confined space program.

Confined Space: A space that: 1) is large enough and so configured that an employee can bodily enter and perform assigned work 2) has limited or restricted means for entry or exit (tanks vessels, silos, storage bins, vaults, hoppers, pits, etc.) 3) is not designed for continuous employee occupancy

Combustible: A material that will burn under most conditions and may ignite easily depending upon its flash point. The DOT defines a combustible liquid as a liquid with a flash point above 141 degrees F. and below 200 degrees F. Both the NFPA and OSHA generally define a

combustible liquid as a liquid with a flash point at or above 100 degrees F and below 200 degrees F.

Compressed gas: Any material contained under pressure, i.e. dissolved gas or liquefied by compression or refrigeration.

Entry Permit: The written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in the entry permit.

Inerting: The displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

OCWIP: Owner Controlled Wrap-up Insurance Program. Insurance program funded by the Metropolitan Washington Airports Authority for all contracting personnel working on construction projects at the airports which covers workman's compensation, general liability, builder's risk, excess liability and pollution liability coverage.

PPM: Parts Per Million. Parts of vapor or gas per million parts of air by volume at 25 degrees C and 1 atm pressure.

TLV: Threshold Limit Value. A term used by the ACGIH to express the airborne concentration of a material to which most workers can be exposed during a normal daily and weekly work schedule without adverse effects.

1. TLV-TWA: allowable time-weighed average concentration for a normal 8-hour workday or 40-hour workweek.
2. TLVSTEL: the short-term exposure limit or maximum concentration for a continuous exposure period of 15 minutes (with a maximum of 4 such periods per day, with at least 60 minutes between exposure periods.
3. Ceiling: the concentration not to exceed at any time.

Z-List: OSHA's Toxic and Hazardous Substance Tables Z-1-A, Z-2 and Z-3 of air contaminants (29 CFR 1910.1000). Any material found in these tables is considered hazardous.

IV. General Safety

Hard Hats: Required at all times, in designated areas, when appropriate. Hard hats must meet OSHA and MSA safety standards.

Ladders: Ladders must be in good condition, made of suitable material, of proper length and of the correct type for the use intended. Ladders used near electrical equipment must be made of a non-conductive material. Ladders should be checked each and every time before climbing to ensure that they are in good condition.

Safety Glasses: Safety glasses, goggles and face shields shall be worn in correspondence to the degree of the hazard, i.e. dust, impact hazard, chemical splash, etc., and at all times where there

is a risk of eye injuries such as puncture, burns or contusions. Use of eye protection shall correspond to OSHA and Metropolitan Washington Airports Authority safety regulations.

Safety Shoes: Appropriate hard-soled footwear (steel-toed not mandatory, but recommended) must be worn at all times while working on Metropolitan Washington Airports Authority property. This will minimize the risk for injuries from hot, corrosive, poisonous substances, falling objects and crushing or penetrating actions.

First Aid Kits: All service vehicles shall be equipped with OSHA approved first aid kits. Kit should be inspected monthly to ensure their completeness and readiness for use.

Fire Extinguishers: Fire extinguishers must be UL and NFPA approved and should be used per their classification:

- Class A - Ordinary combustible material fires
- Class B – Flammable liquid, gas or grease fires
- Class C – Energized-electrical equipment fires
  - Appropriate fire extinguishers must be mounted within 75 feet of outside areas containing flammable liquids and within 10 feet of any inside storage area for such materials.
  - All extinguishers must be serviced, maintained and tagged at intervals not to exceed one year.

Tools: All tools will be inspected prior to their use to ensure that they are in good working order per manufacturer guidelines. Electrical or mechanical tools must be used in compliance with UL and OSHA recommendations.

Smoking: At no times shall smoking be allowed in communication and equipment rooms, inside Metropolitan Washington Airports Authority buildings, nor in any restricted area designated by the Metropolitan Washington Airports Authority.

Confined Space: Ventilation must be either natural or mechanically provided into the confined space. All hazardous or corrosive substances that contain inert, toxic, flammable or corrosive materials must be valved off, blanked, disconnected and separated. Atmospheric tests should be performed to check for oxygen content, toxicity, and explosive concentration. Atmospheric tests must be performed on a regular basis in a confined area where entry is required. The area must be checked for decaying vegetation, or animal matter that could produce methane. Adequate lighting must be provided within the space. If the confined area is located below the ground or near where motor vehicles are operating, care must be taken that vehicle exhaust or carbon monoxide does not enter the space. When personnel enter a confined area, assigned safety standby employees who are alert to the work being done, are able to sound an alarm necessary and to render assistance, must be in the area. These standby employees must be trained to assist in handling life lines, respiratory equipment, CPR, first aid and be able to employ rescue equipment that will remove the individual from the confined area. There must also be an effective communication system utilized while the operation is occurring. When equipment which utilizes oxygen, such as salamanders, torches, etc., is used in a confined space, adequate ventilation must be provided to guarantee oxygen content and combustion for the equipment.

Compressed bottled gas must be outside the area and torches must be lit outside the area too. The atmosphere must be tested each time before lighting a torch.

Electrical Safety: The workplace will be aware of the OSHA Electrical Safety Orders and will comply with the same. Preliminary inspections or appropriate tests to determine conditions before starting work must be made. When equipment or lines are to be serviced, maintained or adjusted, employees must be aware of open switches. Lockouts must be tagged. Equipment such as electrical tools must be grounded or of the double insulation type. Extension cords must have a grounding conductor. Sufficient access and working space must be provided and maintained around all electrical equipment to permit ready and safe operations and maintenance. A means of disconnecting electrical equipment must always be accessible.

Traffic and Transportation: Personnel operating or riding in vehicles on either Airport campus are required to wear safety belts at all times. Operators must possess a valid State driver's license and Metropolitan Washington Airports Authority certified credentials to transverse the AOA in an approved vehicle. All personnel who are required to direct traffic must possess DOT flagman certification.

Chapter VIII

Inspection, Testing and Quality Assurance

Field testing of cable, both copper and fiber, requires a set of measurable transmission parameters along with necessary field test instruments that have been calibrated to manufacturer specifications. Structured cabling is standardized in ANSI/TIA/EIA-568 and field testing is standardized in ANSI/TIA/EIA TSB67. The term cabling includes all components such as cable, patch cords, equipment cords and connecting hardware.

I. Copper Cabling Tests:

Continuity: A continuity test determines if the individual conductors are connected correctly. Copper continuity can be tested using a resistance measurement, but detecting a split pair on a multi-pair cable requires more than a simple resistance check. In a multi-pair cable the test should include:

1. Continuity to the remote end
2. Shorts between any two conductors
3. Transposed pairs
4. Reversed pairs
5. Split pairs
6. Shield continuity (only on shielded cable)
7. Grounded conductor

Length: A length test determines the electrical length of the cabling. A time domain reflectometer (TDR) method is used to calculate the length of a cable by measuring the time it takes a pulse to travel down the cable and back (round trip delay).

Attenuation: In field measurements is an insertion loss measurement. Insertion loss is the loss in signal strength between a source and receiver. Most requirements are based on the insertion loss. The smaller the loss in dB, the better the performance.

Return Loss: Is a measurement of the power reflected from the cabling (in dB). The ratio of the reflected voltage to the incident voltage is used to determine the return loss. The larger the value in the return loss in dB, the better the performance.

Noise: External noise can contribute to performance degradation on any transmission system (with the exception of fiber). Noise levels can be affected by installation practices. Potential sources of noise are electromagnetic equipment and other cabling. Noise testing is not mandatory for twisted pair acceptance, however it does serve as a benchmark for potential noise sources at initial installation.

Near-end Crosstalk Loss (NEXT): Is a measurement for multi-pair cabling whereby the larger the value of NEXT loss in dB, the better the performance. NEXT loss is a measure of the signal coupling between any two pairs along the entire length of the cabling.

Propogation Delay/Delay Skew: Is the time needed for a signal to travel down a cable. The Delay Skew is the differences in the propogation delay between the fastest and slowest pairs in the same cable.

All twisted pair installations on the airport campuses must be performed per TIA/EIA/TSB67 Channel configuration methods.

Test Limits: The test limits for twisted-pair cabling are defined in the BICSI TDMM, Section 10, page 10-10 or the ANSI/TIA/EIA-568-A and addenda.

Test Equipment: Currently, test instruments to be used for testing twisted-pair Category 6 cabling must be IIe or better. Level III instruments are under development at this writing for Category 6, and may be required in the future.

Testing Process: Copper cabling field testing procedures are outlined in the BICSI TDMM, Section 10, pages 10-12 to 10-19.

II. Fiber Cable Testing:

All fiber cable being installed shall be tested using an Optical Time Domain Reflector (OTDR) for attenuation and length.

Attenuation: Is optical power loss measured in dB. The physical properties of fiber splices, connectors, adapters and switches all contribute to the total system attenuation.

Length: Is measured to ensure the link does not exceed application-based requirements.

Optical Time Domain Reflector Testing: Outlined in the BICSI TDMM, Section 10, pages 10-21 to 10-40.

III. Inspection:

Prior to acceptance of all copper and fiber placements, the Metropolitan Washington Airports Authority Telecommunications Division (MA-620) must inspect and certify the plant as meeting Metropolitan Washington Airports Authority Design Manual, BICSI, ANSI/TIA/EIA, ISO, NEC, and NFPA codes and standards.

IV. Quality Assurance:

Through a stringent series of reviews and inspections, the Metropolitan Washington Airports Authority Telecommunications Division (MA-620) ensures that all physical plant consistently meets or exceeds industry standards. The Metropolitan Washington Airports Authority Design Manual denotes many references, codes and regulations to which each installer of telecommunications cable and hardware must adhere. Through continued membership in organizations such as BICSI, as standards and recommendations change due to technological

advancements, the Metropolitan Washington Airports Authority Design Manual will be updated to ensure quality performance and industry compliance.

Chapter IX

Drawings and Documentation

I. General Requirements:

All testing documentation must be submitted in both hard copy and electronic format. As-built drawings must be submitted in AutoCAD2000 or later format. Copper test results must be in EXCEL, while fiber test results will be generated via an OTDR (Optical Time Domain Reflector).

II. Definitions:

See attachment.

III. Layers, Line styles and Symbols

Guidelines for drawings must adhere to the Metropolitan Washington Airports Authority master layering scheme.

Chapter X

Firestop

Firestopping is the process of installing specific materials into openings or penetrations of fire rated barriers that will restore the integrity of the barrier back to its original rating.

I. Reference:

1. NEC 2002, section 800.52
2. ANSI/NFPA-70
3. ANSI/TIA/EIA-569-A
4. BICSI guidelines as referenced in chapter 15 Firestopping

The above references provide guidelines to restore the integrity of a fire-rated structure or assembly that has been penetrated by telecommunication cable trays, innerduct, conduits, fiber cables and telecommunication cables. It is the responsibility of the contractor to comply with all local codes and the Metropolitan Washington Airports Authority guidelines for fire protection.